Section 5
Projected Shortfalls and Potential Solutions for Localized Areas

In aggregate and assuming water can be moved from where it is produced to where it is needed, enough water is available from existing supplies in King County (County) to meet total countywide projected demand beyond 2020. However, since there are currently limitations on the movement of water throughout the County, there are some areas in which existing sources of supply, while able to meet current demand, are not sufficient to meet anticipated growth in local demand over the next 20 years. Based on a review of various data sources, 20 individual Group A Community water systems have been identified as having potential shortfalls in the coming years[(1)]. Many of these systems have developed specific plans to undertake supply improvements to address shortfalls, as discussed in detail in this section. Implementation of these plans will require sustained efforts, and in some cases, resolution of certain policy issues.

5.1 Countywide Water Supply and Demand Analysis

An analysis was performed as a part of the 2001 Central Puget Sound Regional Water Supply Outlook (Outlook) to compare aggregate water supplies and demands on a countywide basis, in order to determine the overall magnitude of water supply deficiencies and/or excesses in King, Pierce, and Snohomish Counties. However, there are a number of limitations associated with this type of analysis. When adding up the supply capacities of many systems, it is important to recognize that there are varying standards upon which capacities are based. Furthermore, the concept of aggregating supply capacities implies that water can be simply transferred from one area of a county to another, which is currently not the case in King County.

This section presents a summary of the results of the Outlook aggregate water supply and demand analysis for King County, followed by a discussion of the many different ways in which water systems define source yield and reliability, the parameters upon which supply capacities are based.

[(1)] This shortfall analysis is based upon information provided by the utilities. As discussed later in this section, the list of 20 individual utilities identified as having potential shortfalls does not fully depict the many challenges likely to be faced primarily by small water systems throughout King County in the coming years. Section 6 presents a more detailed discussion of the magnitude of potential problems that these smaller water systems in the County may experience.

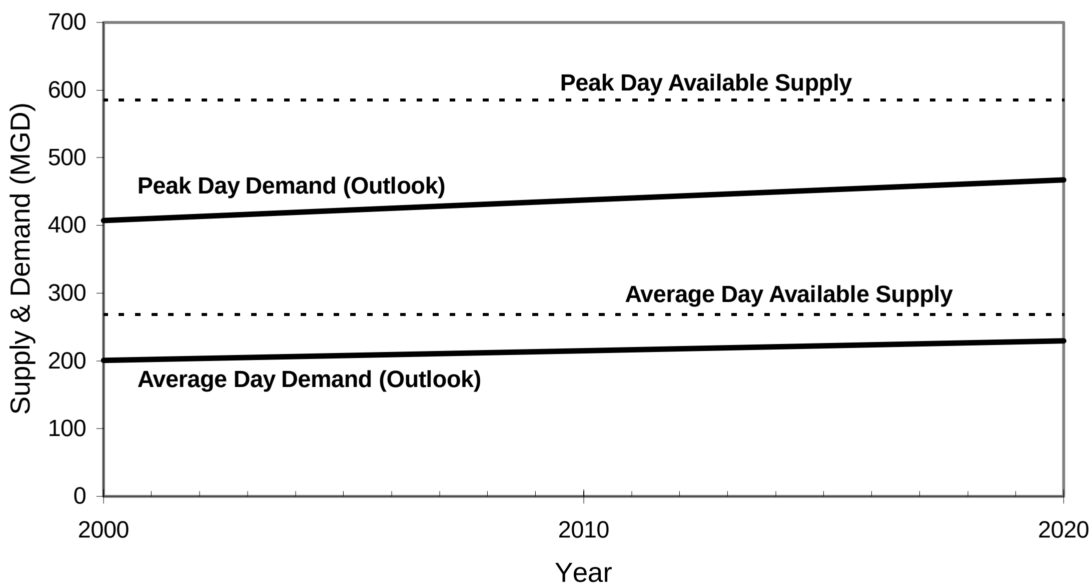
5.1.1 Analysis of Aggregate Water Supply and Demand for King County

For these comparisons, the total supply of all water systems that were surveyed in a county during the Outlook was compared with the total demand associated with the same systems. The following is a description of how these "regional" supplies and demands were determined and compared:

- ❑ Average and peak day demands were calculated as the sum of all system demands within the county. The system demands used in this calculation came from a regionally consistent demand projection methodology utilized for all systems.
- ❑ Supply data included water rights, resource constraints, and infrastructure capacity.
- ❑ The "available supply" for each water system is the amount of water available based on the most limiting of three constraints: water rights, infrastructure capacity, or resource capacity. Source yield and reliability are parameters that aid in defining available supply, as discussed below in Section 5.1.2. Once defined, individual water system available supplies were then added up within each county.
- ❑ In a very few cases, some smaller systems did not provide any information about their supplies. For these systems, the "available supply" was conservatively assumed to be equal to their 2000 peak day demands. This is based on the assumption that each system's supply is at least sufficient to meet 2000 demand. Due to the small number and size of systems that did not provide any supply information, this assumption had a minimal effect on the overall results.
- ❑ The supplies and demands shown in the county comparisons do not include smaller systems (i.e., those generally with fewer that 500 connections) and private wells. As described in Section 2, the large systems that are included in this comparison represent approximately 94.5 percent of the total King County population.

The results of the aggregate supply and demand analysis are shown in Exhibit 5-1. From 2000 to 2020, the forecast demand for the entire County is less than estimated aggregate municipal supply capacity.

Exhibit 5-1
King County Supply/Demand Comparison

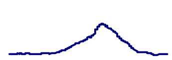


5.1.2 Source Yield and Reliability

While water demand is relatively easy to quantify and compare across water systems, water supply is much more difficult to define in a precise and consistent way. Many different factors determine how much water can be obtained from a particular source. These include, but are not limited to, annual water rights, instantaneous water rights, stream flow variability, required minimum instream flows, aquifer recharge rates, and conjunctive use opportunities.

In general, source yield can be defined as the maximum level of annual average demand(2) that a system's supply source (or sources) could meet on a sustainable basis. However, in determining yield, it is useful to classify supply sources into three broad categories:

1) Sources where more water is physically available than the water rights allow to be withdrawn. These can be either surface- or ground-water sources. What they have in common is that the water right is small

(2) Implicit in a utility's annual average demand is its seasonal peaking profile: 

relative to the capacity of the source. The constraining factor is the water right. Examples: Ames Lake, Black Diamond, Fall City.

2) Groundwater sources with less water available than specified by the water rights. Examples: Kent, Lakehaven.

3) Surface water sources with less water available (some or all of the time) than specified by the water rights. Example: Seattle system.

The first category poses the fewest problems in determining yield since the water is always available. Step one is to ascertain whether the ratio of instantaneous to annual water rights is greater or less than the peak day to annual average demand factor. If the water right ratio exceeds the peak demand factor, then the system yield is equal to the annual water right. If the water right ratio is *less than* the peak demand factor however, the system is constrained by the instantaneous water right (Qi). In that case, yield (expressed in annual average terms) is equal to the Qi divided by the peak demand factor.[3] (This assumes enough storage to equalize consumption over a 24-hour period.)

The challenge with the second category of sources is often lack of information. It may not be known how much water can be pumped without depleting the aquifer. Adding to the uncertainty may be diminishing recharge (due to more and more area covered by impervious surfaces) or issues of hydraulic continuity. The manager of such a system may know that less water is available than specified in the water right but may have only a rough estimate of the amount.

Finally, yield for the third category of supply resource is not defined by water rights, but rather by the amount of water that must be left behind. Over the last half century, there has been growing recognition of the importance of keeping sufficient water in streams for fisheries and other environmental factors. By 1971, the legislature had enacted statutes authorizing the establishment of minimum stream flows and assigning some of those flows the same status as private appropriations. Some water systems with surface water sources set their own minimum instream flow standards and voluntarily commit to maintaining them.

The maximum amount of water that can be diverted from these sources is that which at least maintains the required minimum instream flows. However, there is a high degree of uncertainty in determining that maximum amount because weather-induced variability in flows can cause the amount of

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[3] For example, consider two systems, each with a peak day demand factor of 2 and each with a well the production from which is constrained only by the water rights. Both have annual water rights (Qa) of 10 mgd but System A has a Qi of 30 mgd while System B's Qi is only 16 mgd. What are the yields? When System A's annual average demand reaches the Qa of 10 mgd, peak day demand is 20 mgd – still less than the Qi of 30 mgd. Therefore, System A's yield is equal to its Qa: 10 mgd. However, since System B cannot exceed 16 mgd of peak day demand without violating its water right, its maximum annual average demand and therefore its yield is limited to 16 mgd divided by the peak factor of 2 equals 8 mgd.

water available to vary tremendously from year to year. Characterizing the yield from this kind of source is therefore somewhat complex and requires the concept of supply reliability.[4]

The level of demand that can be supplied from a water supply system that meets a particular reliability standard is termed the “firm yield” of that water supply system. Supply reliability refers to what percent of the time a supply system is able to meet a particular level of demand. It is often not economical to require a water supply system to meet full system demands under the worst conditions. A reliability standard is used to balance the level of risk of not being able to meet water demands in the driest years with the cost of developing additional supply sources.

For example, consider a water system with 100 years of historical weather data and a yield model that estimates its firm yield at 75 million gallons per day (mgd) with 98 percent reliability. This means that in the worst two years on record (in terms of rainfall, snow pack, temperature, etc.) the system would not be able to meet average annual demand of 75 mgd. However, in 98 out of 100 years, the system would be expected to be able to deliver at least 75 mgd. In most of those years, the amount of water the system could produce would be more, sometimes much more, than the rated firm yield. Also, 98 percent is the minimum reliability. The standard is applied at the point in the planning horizon where demand equals the firm yield number produced by the 98 percent reliability standard. Prior to that point, demand is less than the firm yield number and supply reliability is greater than 98 percent. In fact, water systems with demand comfortably less than their supply capacity often don’t bother to define reliability or calculate firm yield.

A common misconception is that 98 percent reliability means that as long as demand doesn’t exceed firm yield, a water shortage situation requiring customers to curtail their demand would only occur in two out of 100 years. The problem is that more often than 2 percent of the time, conditions early in a year indicate the *possibility* of a water shortage. While in most of these cases, it turns out that there’s enough water to meet demand equal to firm yield, there’s no way to know in advance. Therefore, a prudent manager will begin implementing demand reduction measures before it’s known for certain whether they’re necessary. Waiting until there’s no doubt a shortage is occurring risks catastrophe because by then, it’s usually too late to take effective action.

[4] The distinction between *supply* reliability and *system* reliability is important. System reliability has to do with how well the system functions in the event of the failure of some component of the delivery system infrastructure (e.g., a pipeline break or power outage at a pumping station.) System reliability can be enhanced with redundancies in the system: parallel pipelines, alternative power sources, etc. As discussed above, supply reliability is related to the variability of supply at the source, usually a function of weather. Supply reliability can be maximized by counting as firm yield only the water a source can produce under the worst possible supply conditions.

Different standards of reliability can produce very different estimates of firm yield. In the example above, increasing reliability from 98 percent to 100 percent could cause the estimate of firm yield to shrink significantly, say from 75 mgd to 60 mgd, and require the rapid development of a new source of supply. Relaxing the reliability standard to 95 percent might increase firm yield to, say, 90 mgd, (and postpone the need for new supply) but if demand were allowed to grow into that additional yield, the frequency of demand curtailment requests in response to potential shortage situations would also increase. The optimal level of reliability is that which balances the costs of occasional demand curtailments with the costs of developing new supply sources.

It is tempting to add up all the source yields reported by individual water suppliers in the County to obtain an estimate of total King County water supply. One might think that comparing this to aggregate King County water demand would provide an overall picture of the water supply situation in the County. However, there are numerous pitfalls in doing this. As explained above, there is little consistency in how different systems characterize their supply. Some yield estimates are based on water rights and others on availability. Some take into account seasonal demand patterns, others do not. Some are based on sophisticated yield models, others are rough estimates. Some employ a reliability standard, others do not. Some are based on conservative assumptions, others less so. The result is a classic case of trying to add apples and oranges.

Aggregating supply and comparing it to total demand countywide also implies that water can be freely moved around from where it is in surplus to where it is needed. Currently this is not the case in King County. There are many barriers, both physical and institutional, that prevent such a movement of water. But if all such barriers could be removed and if a consistent methodology for calculating yield were used across all utilities, the sum of individual source yields would still not render an accurate picture of aggregate supply because it would ignore conjunctive use benefits, as discussed earlier in Section 4.3.

5.2 Individual Utilities with Projected Shortfalls Before 2020

Comparisons of average day and peak day demand projections with existing available supply were utilized to identify individual utilities with projected shortfalls prior to 2020. This analysis is based upon the best available information obtained from the various data sources discussed earlier in Section 1.2.

Analysis of individual Group A Community systems is presented, based on information developed for Phase 2 of the Outlook. This analysis is followed by discussions of the water supply quantity concerns faced by Group A Non-Community systems, Group B systems, and individual household wells, which were developed specifically for the Consolidated Report. The result of this analysis provides numerous perspectives on the water supply needs within the County for the next 20 years.

It is important to recognize that the identification of potential water-supply shortfalls presented here does not take into account new increments of supply that may be developed in the future. Consistent with the Outlook process, which provided much of this information, the intent is to identify potential shortfalls initially, prior to consideration of potential solutions.

5.2.1 Summary of Water Supply Shortfalls

The results of this water quantity analysis are twofold:

- On an individual utility basis, 20 Group A Community water systems have been identified as having potential water supply shortfalls before 2020. These systems are located on Exhibit 5-2.

  Of these 20 systems, 10 are "large" systems (i.e., more than 500 connections) for which detailed analyses have been performed. These systems are listed in Table 5-1. The remaining ten systems are small Group A community water systems (i.e., generally less than 500 connections) that have not been analyzed in detail as a part of this report. These systems are listed below:

  - Auburn Mobile Park
  - Burton Water Company
  - Dawnbreaker Water Association
  - Dockton Water Association
  - Grotto Water Company
  - Heights Water
  - Meridian Meadows
  - Sunset Park Water Company
  - Valley View Trailer Park
  - Y Bar S Water Company

- For Group A Non-Community systems, Group B systems, and individual household wells, water quantity issues are generally of lesser concern due primarily to their non-expanding nature. However, these systems can be susceptible to different kinds of problems, as discussed in Section 6.

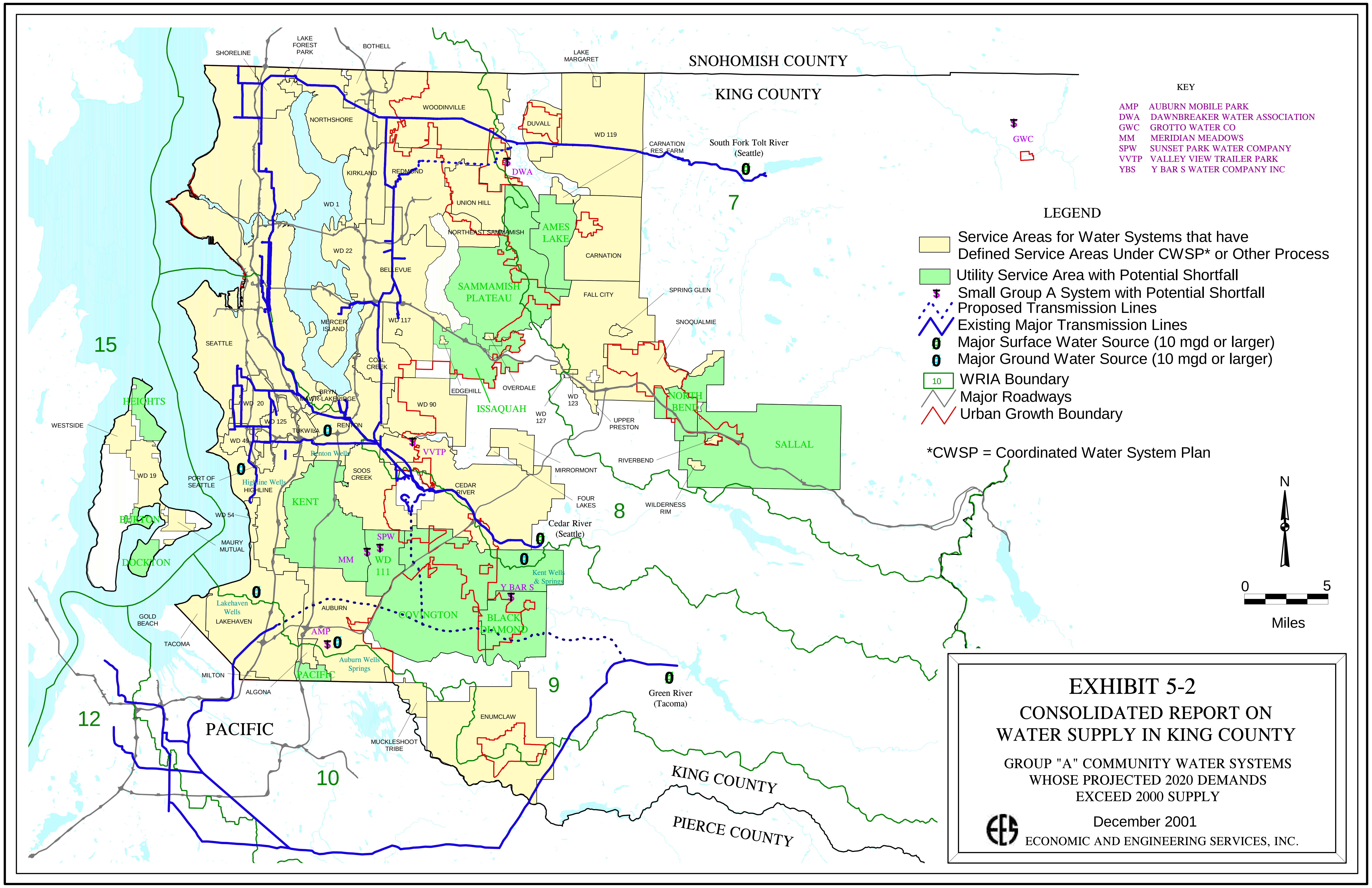

EXHIBIT 5-2

CONSOLIDATED REPORT ON WATER SUPPLY IN KING COUNTY

GROUP "A" COMMUNITY WATER SYSTEMS WHOSE PROJECTED 2020 DEMANDS EXCEED 2000 SUPPLY

December 2001

ECONOMIC AND ENGINEERING SERVICES, INC.

Table 5-1
Areas in King County where Projected Demand Exceeds Existing Supplies(1)

Shortfall Area	Year Projected Demand Exceeds Existing Supply
Ames Lake Water Association	2013
Black Diamond Water Department	2007
Covington Water District	2002
Issaquah Water System	2003
Kent Water Department	2000
King County Water District 111	2012
City of North Bend	2000
City of Pacific	2000
Sallal Water Association	2008
Sammamish Plateau Water & Sewer	2002

Footnotes:
(1) In aggregate and assuming water can be moved from where it is produced to where it is needed, enough water is available from existing supplies in King County to meet total countywide projected demand beyond 2020. However, since there are limits on the movement of water throughout the County, there are some areas in which existing sources of local supply, while able to meet current demand, are not sufficient to meet anticipated growth in local demand over the next 20 years.

5.2.2 Group A Community Water Systems Analysis

This analysis involves water supply and demand comparisons on an individual water system basis for all Group A Community systems (those listed in Table C-1 of Appendix C) in an effort to identify potential local areas of concern. Due to the various sources of data reviewed for the Group A Community systems, multiple analysis methods were employed, as described below.

Outlook Findings

As part of the efforts of the Outlook, individual utility analyses have been performed for the larger Group A systems within King County (generally, those having greater than approximately 500 connections). In total, these systems serve 94.5 percent of the County population. These analyses compare projected average and peak day demands through year 2020 with existing supplies that are currently in place, taking into consideration water rights, purchase agreements, and physical supply constraints. The data utilized for individual utility analyses were provided by the utilities themselves. Table 5-2 presents a list of these utilities along with the results of the analysis. The ten shaded utilities are ones for which projected demand is projected to exceed existing supply before 2020. Appendix F contains the detailed analysis for these ten specific utilities.

Table 5-2
Summary of Outlook Supply/Demand Comparison for Individual Utilities
(values in MGD)

Utility	Average Day Conditions: 2020 Demand (ADD) [1]	2000 Supply Constraint	Type of Constraint [2]	Year that ADD Exceeds 2000 Supply [3]	Maximum Day Conditions: 2020 Demand (MDD) [1]	2000 Supply Constraint	Type of Constraint [2]	Year that MDD Exceeds 2000 Supply [3]
King County								
King County Utilities Supplied Solely by Seattle Regional System								
Bellevue	21.90	N/A (Contract)			49.82	N/A (Contract)		
Bothell	1.71	N/A (Contract)			3.32	N/A (Contract)		
Coal Creek	3.12	N/A (Contract)			7.80	N/A (Contract)		
Duvall	0.60	N/A (Contract)			1.21	N/A (Contract)		
King 119	0.33	N/A (Contract)			0.75	N/A (Contract)		
King 125	2.28	N/A (Contract)			5.60	N/A (Contract)		
King 20	2.99	N/A (Contract)			7.32	N/A (Contract)		
King 45	0.19	N/A (Contract)			0.47	N/A (Contract)		
King 49	1.74	N/A (Contract)			4.26	N/A (Contract)		
King 85	0.16	N/A (Contract)			0.32	N/A (Contract)		
King 90	1.42	N/A (Contract)			3.11	N/A (Contract)		
Kirkland	4.14	N/A (Contract)			7.63	N/A (Contract)		
Mercer Island	3.61	N/A (Contract)			9.06	N/A (Contract)		
Northshore	7.08	N/A (Contract)			14.15	N/A (Contract)		
Seattle	(4)	(4)			(4)	(4)		
Shoreline	2.32	N/A (Contract)			3.76	N/A (Contract)		
Skyway	0.37	N/A (Contract)			0.64	N/A (Contract)		
Soos Creek	5.24	N/A (Contract)			14.15	N/A (Contract)		
Tukwila	4.30	N/A (Contract)			8.39	N/A (Contract)		
Woodinville	5.79	N/A (Contract)			17.21	N/A (Contract)		
King County Utilities Supplied by Seattle Regional System AND Local Sources								
Bryn-Mawr	0.43	N/A (Contract)			0.61	N/A (Contract)		
Cedar River	3.60	N/A (Contract)			8.10	N/A (Contract)		
Highline	7.94	N/A (Contract)			19.84	N/A (Contract)		
Redmond	8.81	N/A (Contract)			21.14	N/A (Contract)		
Renton	10.93	N/A (Contract)			20.98	N/A (Contract)		
Union Hill	1.02	N/A (Contract)			2.54	N/A (Contract)		
King County Utilities Supplied by Tacoma Regional System AND Local Sources								
Lakehaven	13.83	15.40	Resource Constraints & Purchase Limits		29.60	34.00	Resource Constraints & Purchase Limits	
Enumclaw	5.05		Contract		6.30		Contract	
King County Utilities Supplied Solely by Local Sources								
Algona	0.41				1.01			
Ames Lake	0.40	0.33	Water Rights	2013	0.65	0.68	Water Rights	
Auburn	(4)	(4)			(4)	(4)		
Black Diamond	1.63	0.49	Water Rights	2007	4.07	5.24	Water Rights	
Carnation	0.28				0.70			
Covington	6.54	6.92	Water Rights & Purchase Limits		13.30	9.42	Water Rights & Purchase Limits	2002
Fall City	0.40	0.81	Water Rights		0.81	1.49	Water Rights	
Issaquah	3.79	2.50	Water Rights	2003	4.46	5.59	Water Rights	
Kent	14.06	17.00	Resource Constraint		24.89	17.00	Resource Constraint	2000
King 1	0.03	1.30	Water Rights		0.07	0.32	Infrastructure Capacity	
King 111	3.09	4.47	Water Rights & Purchase Limits		6.60	5.27	Water Rights & Purchase Limits	2012
King 54	0.36	1.49	Water Rights		0.70	2.52	Water Rights	
Mirrormont	0.23	0.54	Water Rights		0.49	0.93	Water Rights	
NE Sammamish	1.01	2.06	Water Rights		2.52	2.98	Water Rights	
North Bend	0.99	0.30	Water Rights	by 2000	2.30	3.23	Water Rights	
Pacific	0.91	2.41	Water Rights		3.27	2.45	Water Rights	by 2000
River Bend	0.23	0.50	Water Rights		0.46		Water Rights	
Sallal	0.90	0.71	Water Rights	2008	1.55	2.44	Water Rights	
Sammamish Plateau	9.10	6.15	Water Rights	2004	24.40	14.18	Water Rights	by 2000
Snoqualmie	0.66	0.72	Resource Constraint		1.58	2.60	Infrastructure Capacity	
Wilderness Rim	0.17				0.38			

N/A = Not Applicable   ADD = Average Day Demand   MDD = Maximum Day Demand

Notes:
(1) Demands projected for year 2020, reported directly by each utility. If a utility did not report data, regionally consistent projections from the Outlook were used instead.
(2) Constraints indicate a limit on available supply in year 2000. The various constraints are described as follows:
- "Resource constraints" are physical characteristics of the water resource, such as the firm yield of a watershed; the yield of an aquifer; limitations based on fisheries needs, etc.
- "Infrastructure capacity" is the peak day physical capacity of wells, pumps, diversion structures, etc.
- "Water rights" includes annual quantity (Qa) for average day; and instantaneous quantity (Qi) for peak day
- "Contract" indicates the utility purchases water from a wholesale supplier; often without a set limit on quantity purchased.
- "Purchase Limits" refers to specific quantity limits in arrangements with wholesale supplier.

(3) Shading indicates that the utility's projected 2020 demand exceeds 2000 supply.
(4) Seattle and Auburn supply water to both wholesale and retail customers. Seattle's existing supply and planned improvements are adequate to meet retail and wholesale demands through 2020 (see Section 2.6 for details). Auburn has adequate supply to meet retail demands through 2020, while supplies are not adequate to meet wholesale customer demands (see Appendix G for details).

Review of Water System Plans and Follow-Up Surveys for Selected Water Systems

For some systems that were not included in the Outlook Phase 2 analysis, Water System Plans (WSPs) were available from the Department of Health (DOH) for review. In addition, further information was obtained through surveys distributed as part of the Consolidated Report data compilation process. Since the nature of the data is quite similar to that of the Outlook, the comparative analysis method of supply and demand is identical. This method was used for 12 Group A systems having approximately 200-500 connections. Of this group, only one utility (Burton Water Company, Inc.) was identified as having a projected demand exceeding existing supply before 2020. Records of historical usage show that Burton (located on Vashon Island) has been experiencing average day water supply shortfalls since approximately 1990. Burton serves 395 connections.

Phone Interviews

For small Group A Community systems with less than 200 connections, the amount of available data is quite limited. As explained in Appendix A, phone interviews with staff of the local regional water associations and several larger utilities were conducted in order to gain information on systems for which little was known. Through this process, three Group A Community water systems were identified as having potential water supply related problems that could require a change in source prior to 2020. These systems are:

- Y Bar S Water Company, Inc. (serves 105 connections);
- Dawnbreaker Water Association (serves 41 connections); and
- Meridian Meadows (serves 38 connections).

It should be emphasized that there are many limitations associated with this source of data; however, the judgments concerning the individual water systems that were identified via this method as having potential shortfalls were mentioned by more than one person interviewed.

Analysis Using Drinking Water Automated Information Network (DWAIN)

Another way in which to analyze the supply and demand of smaller Group A Community systems is to utilize the information contained within DOH’s Drinking Water Automated Information Network Analysis (DWAIN) database while making assumptions concerning consumption patterns. DWAIN includes a data field listing the source capacity for all systems. It is assumed that this value corresponds to a maximum instantaneous capacity, as the value shown is typically representative of peak well capacity or an instantaneous surface water claim. Comparing this with an estimate of peak day demand yields an analysis similar to that done with the Outlook and WSP data.

Two estimates of peak day demand were made. Both estimates are based on the assumption that for smaller utilities, the number of service connections reported represents an equivalent number of single-family households served. The first estimation method is based on the average daily water usage per household for the County, as determined in the Outlook. This value has been calculated as approximately 250 gallons per household per day (gphd), and is an average of existing usage data for utilities throughout the County. The peak day demand is then calculated by multiplying this average daily usage by the average peaking factor for utilities throughout the County, which has been determined to be 2.0. The resulting peak day demand is 500 gphd. The second estimation of peak day demand stems directly from DOH design standards which specify that with the lack of better data, a water system in western Washington should be designed to meet peak day demand of 800 gphd.

The shortfall analysis is made by comparing the supply capacity reported in DWAIN with the demand estimates using these two methods. If the estimated demand was greater than the reported supply, the utility was identified as having a potential shortfall in supply.

This method identified six additional systems for which demand may exceed, as listed in Table 5-3.

Table 5-3
Group A Community Systems with
Potential Shortfall as Identified by Analysis Using DWAIN[1]

Utility	Number of Connections	Demand at 500 gphd exceeds DWAIN-listed supply	Demand at 800 gphd exceeds DWAIN-listed supply
Heights Water	611		X
Dockton Water Association	350		X
Auburn Mobile Park	63		X
Valley View Trailer Park	50		X
Grotto Water Company	24		X
Sunset Park Water Company	19	X	X

(1) This analysis was applied to Group A systems having 1,000 service connections or less.

5.2.3 Group A Non-Community Systems Analysis

Of the King County Group A water systems listed in DWAIN, there are ten Non-Transient/Non-Community systems and 48 Transient/Non-Community systems, as shown in Table C-2 of Appendix C. These systems represent a wide variety of water users, including schools, campgrounds, recreation facilities, and industrial parks. Likewise, water consumption patterns vary greatly amongst these systems. In some cases, one connection serves an entire park or campground and is only in use for six months out of the year, while greatly fluctuating industrial use is the nature of other systems. These characteristics make it difficult to develop a consistent water supply and demand methodology. It should also be noted that these systems are quite small and comprise less than 0.5 percent of overall water use within the County. For these reasons, and in the absence of available data for these systems, no specific shortfall analysis has been performed.

However, because of their vulnerability and lack of regulatory oversight relative to community systems, non-community systems may be significantly impacted by water quality, administrative, or financial issues. For this reason, non-community systems are considered together with small community systems, in the small system solution framework discussion (see Section 6.4).

5.2.4 Group B Systems Analysis

There are 1,648 King County Group B water systems identified in DWAIN. They serve a population of approximately 16,000 (1 percent of the County population) through 6,305 service connections. For the most part, these systems are non-expanding, and therefore, are not anticipated to experience water supply shortfalls in the future, assuming they have adequate supply available to meet current needs. However, these systems can be susceptible to water quality and administrative/financial concerns. Therefore, they are discussed in more detail in Section 6 of this document.

5.2.5 Individual Household Well Analysis

As discussed in an earlier section, little direct information is available concerning individual household wells within the County. The number of wells has been calculated using indirect methods (see Table 2-6) and equates to approximately 3.3 percent of the total County population. Generally, it is assumed that individual household wells do not have water-supply shortfalls.

5.3 Individual Utilities with Planned Supply Improvements that Address Projected Shortfalls Before 2020

The ten water systems listed in Table 5-1, are currently anticipating that their existing supplies will not be sufficient to meet projected demands through 2020 and have begun to plan accordingly, by investigating potential supply options. These are evolving options, some of which may come to fruition, while others will not.

Adequate data relating to possible supply options was not readily available for the other ten individual systems identified with potential shortfalls. Generally, these other ten systems are smaller, with fewer than 500 service connections. However, the list of ten smaller systems is not a comprehensive list of all the small systems that could potentially experience water supply problems in the next 20 years. A more thorough discussion of this issue is presented in Section 6.

Specific discussions concerning the situations faced by the ten utilities mentioned above are provided in the sub-sections below, as drawn from the 2001 Central Puget Sound Regional Water Supply Outlook. Graphical summaries of these discussions are located in Appendix G. While some of the localized areas discussed below are exploring isolated supply alternatives that apply solely to their geographical areas, many are exploring one or more of the universal supply options discussed in Section 4.

In developing solutions that increase the amount of municipal water supply for a specific area, it is imperative to consider all associated factors and balance the multiple demands upon the region's water resources. In particular, the recent listing of Puget Sound Chinook salmon and Bull Trout as threatened, pursuant to the Endangered Species Act (ESA), has called attention to improving fish habitat in certain area rivers and streams (see Section 3 for details). Environmental considerations will continue to play an important role as water supply solutions are developed throughout King County.

To provide a comprehensive view of water supply situations throughout the County, profiles of the larger individual utilities for which no water supply shortfalls are projected to occur prior to 2020 are presented in Appendix H. These have been developed based upon information obtained from utilities via the Outlook process as well as through follow-up research conducted during preparation of this report.

Some of the individual utility solutions to projected supply shortfalls described below may face significant hurdles. Section 7 of this report describes policy and regulatory considerations that may affect the ultimate feasibility of various proposed solutions.

5.3.1 Ames Lake Water Association, Inc.

Ames Lake Water Association (Ames Lake) serves a population of approximately 2,500. Average day demand is projected to increase from 0.27 mgd in 2000 to 0.4 mgd in 2020. Ames Lake has its own ground water source of supply. The primary constraint on water supply is water rights. Annual average water rights are 0.33 mgd. The utility's demand forecast projects that this annual water right will be exceeded beginning in year 2013. Instantaneous water rights vary throughout the year. They are 0.49 million gallons per day (mgd) in all months except July and August. The July and August instantaneous water rights are 0.79 mgd and 0.68 mgd respectively (though they are subject to some additional constraints). The utility's demand forecast projects that this instantaneous water right will be exceeded beginning in year 2007. However, beginning in 2003, Ames Lake anticipates being able to meet all projected needs via purchased water, as discussed below.

Ames Lake is currently pursuing new wholesale purchases and additional water rights in order to meet their rising demands and avoid future shortfalls in supply. Ames Lake is one of several utilities identified in Seattle's 2001 WSP as potential future wholesale customers of Seattle. The new source of supply would be from Seattle's Tolt Pipeline, however, water would be delivered through an intertie with Sammamish Plateau. It is possible that a contract for wholesale water purchases will be finalized in 2003. The quantities of annual and instantaneous supply are not yet known. Ames Lake has also continued pursuing a new water right that would provide them with an additional 0.09 mgd of annual supply. It is estimated that this might be granted by 2004, but granting of a new water right is dependent upon a number of factors still to be evaluated by Department of Ecology (Ecology).

5.3.2 Black Diamond Water Department

Black Diamond Water Department (Black Diamond) serves a population of approximately 2,500 and is projected to grow nearly 20 percent by year 2020. It has its own sources of supply, from springs. Black Diamond cannot utilize its total water rights at this time due to constraints on pumping capacity. However, despite planned improvements to utilize full pumping capacity, Black Diamond still expects a shortfall in the available supply. Black Diamond's water rights to this source are limited by an average annual supply of 0.49 mgd. The springs are capable of producing far more than this amount (estimated production is 19 mgd) and the peak flow rate (Qi) allowed by the water rights is for 5.17 mgd. Although the available water is substantial, and the peak flow rate is significantly more than what Black Diamond can utilize, the annual withdrawal rate limits the amount of growth Black Diamond can serve. Based on current growth projections, Black Diamond's projected demands exceed available supply in approximately 2007.

Black Diamond is looking at interties, wholesale purchases, new water rights, and transfer of existing water rights to meet their future annual water supply needs. Additional supply from a new water right or transfer of an existing water right is unlikely due to instream flow requirements. Black Diamond has been talking with a number of other water purveyors in the region to establish additional sources of supply. An intertie with the Covington Water Department (Covington) is one possibility, through which Black Diamond could receive water from Seattle or from the Tacoma Second Supply Project (TSSP). Another option is a direct tap off the TSSP, though this is currently infeasible. No contracts have yet been established. Within the next two years, Black Diamond also plans to make improvements to their pumps in order to fully utilize their existing water rights.

5.3.3 Covington Water District

Covington Water District (Covington) has its own ground water sources with water rights allowing annual withdrawals of 5.4 mgd and instantaneous withdrawals of 7.9 mgd. Covington serves a population of approximately 39,000 and is projected to grow 17 percent by year 2020. Average annual demand in Covington is currently about 4 mgd and is expected to rise to 6.5 mgd by 2020. Peak day demand is about twice the average annual demand. Based on Covington's forecasts, average day demand is projected to exceed Covington's annual water rights by 2011. However, maximum day demand already exceeds Covington's instantaneous water rights.

Covington currently purchases water from Auburn and Seattle to make up the difference in meeting maximum day demand. While Auburn has agreed to provide a maximum of 2.5 mgd (annual average and peak day), it is on an interruptible basis. Seattle has recently granted Covington purveyor status so there is no contractual limitation on how much water can be purchased from Seattle. However with no direct transmission line to Covington, Seattle water must be delivered through the Cedar River Water District. Infrastructure constraints limit the volume of water that can be delivered through this connection to about 1.5 mgd. Water from the Tacoma Second Supply Project (TSSP) is expected to provide a long-term solution to Covington's supply deficit.

5.3.4 City of Issaquah

The City of Issaquah (Issaquah) supplies its demands through use of its own ground water supply as well as some purchased water from the City of Bellevue. Issaquah has two purchase agreements with the City of Bellevue to buy water from the Seattle system. However, they are currently unable to utilize the water available from one of their contracts due to a limited infrastructure capacity. Under their existing system, Issaquah is projected to have a shortfall by 2003. During the next two years, Issaquah will complete improvements to their infrastructure that will allow them to fully utilize their contract purchase amounts.

However, despite a new transmission main to supply their existing contracted purchase quantities, Issaquah still has a projected shortfall after 2012 for their average day demands. Additionally, forecast peak average day demands are expected to exceed their available supply by 2017. Issaquah is seeking additional regional water supplies to meet average and maximum day demands beyond 2012.

5.3.5 Kent Water Department

The Kent Water Department (Kent) serves a population of approximately 50,000 with its own ground water supply. The population served is projected to grow 31 percent by year 2020. Kent's water rights of 25.89 mgd (annual) and 40.25 mgd (instantaneous) would be adequate to meet projected demands through year 2020. However, peak day production is limited, due to potential hydraulic continuity between the aquifer serving Kent and nearby surface waters that have instream flow requirements. This constraint on pumping limits Kent's sustainable peak capacity to 17 mgd. As a result, Kent's peak day demand exceeds the resource constraint in year 2000.

Kent is pursuing a number of short and long-term future supply options to help meet their forecast demands and overcome resource constraints on their sources of supply. In the near-term, the City of Kent is pursuing a new water right and is a co-owning partner of the Tacoma-Seattle Intertie and the Tacoma Second Supply Project (TSSP). In very rough terms, the TSSP should provide Kent an additional 8 mgd of peak day supply capacity. This will allow Kent to meet peak day demands through approximately 2018. To address demands further in the future, an impoundment storage facility, located on city property, is expected to supply sufficient resources to meet future peak day demands beyond 2020. In the first phase, expected to be complete in 2011, an additional 7 mgd of peak day supply capacity will be added. At the completion of Phase 2 in 2020, 4 mgd will be added. The exact quantities that these will provide on an annual average basis has not yet been determined, although Kent believes it will provide plenty of supply to meet their forecasted demands through 2020.

5.3.6 King County Water District No. 111

King County Water District No. 111 (Water District No. 111) has its own ground water source, and also purchases water from Auburn. Water District No. 111 serves a population of approximately 15,000, and is projected to grow 42 percent by year 2020. Annual water rights were reported to be 1.97 mgd, and instantaneous water rights were reported to be 2.77 mgd. The water district's purchases from Auburn are interruptible and limited to 2.5 mgd on both an average day and peak day basis. Water District No. 111's forecasts indicate it has adequate supply (with purchases from Auburn) to meet average day demands through year 2020. However, even with purchased water, the peak day demand is projected to exceed available supply by year 2012.

Near-term plans by Water District No. 111 to increase their sources of supply include aquifer recharge, new purchases, and improvements to existing infrastructure. The improvements to existing infrastructure include a new pump, which would supply approximately 0.14 mgd of new supply. Recharge to a Lakehaven aquifer via Auburn is another potential solution to meeting peak day demands. Water District No. 111 would use winter surplus water to recharge the aquifer, providing enough water for three months of peaking use. Additionally, Water District No. 111 has been identified by Seattle as a potential future wholesale customer.

5.3.7 City of North Bend

The City of North Bend supplies all of its water demands through its own ground water (springs) source. The population served by North Bend's water system is approximately 4,900, and is projected to grow 41 percent by year 2020. Average day demand already exceeds the City's annual water rights of 0.30 mgd. Peak day demand forecasts by North Bend remain below instantaneous water rights of 3.23 mgd beyond year 2020. No other constraints were reported for this system.

North Bend is pursuing new water rights and wholesale purchases to help meet potential shortfalls in their average day demands. They have applied for additional water rights for a drilled production well and for Mount Si Springs that would increase their annual water right limits to their instantaneous right. A change in their water right, dependent on an evaluation and decision by Ecology, would increase their annual allowable water right by 2.93 mgd, for a total of 3.23 mgd. North Bend has been identified as a potential future wholesale customer of Seattle. Water from this arrangement would be obtained indirectly via a connection to the Sallal Water Association.

5.3.8 City of Pacific

The City of Pacific owns 2 well systems with combined water rights of 1.4 mgd annual and 2.5 mgd instantaneous. However, the 2 wells are in close proximity to each other and cannot be operated simultaneously at peak capacity. Peak day production is limited to 1.9 mgd. The Pacific water system serves a population of approximately 6,500. The population served is projected to grow 38 percent by year 2020. Pacific also delivers water to Webstone Water District in Pierce County. Pacific appears to have enough water to meet its annual average demand through 2020 but is severely peak constrained. Based on the Outlook demand forecast, Pacific's peak day demand already exceeds its instantaneous capacity. Pacific has an emergency intertie with Auburn, which it has exercised on occasion since 1995 in order to meet peak demands, but is not a regular wholesale customer.

Pacific is pursuing a number of future supply options to meet their existing and future peak demands. They have talked to a number of water suppliers in an attempt to purchase water. Pacific has not yet been able to enter into a contract with any of the water purveyors they have spoken with. In addition to water purchases, they are also investigating the potential for developing a new storage reservoir within their water service area.

5.3.9 Sallal Water Association, Inc.

Sallal Water Association serves a population of approximately 3,800 and is projected to grow by 35 percent between year 2000 and 2020. It has its own ground water source. Instantaneous water rights appear adequate to meet projected peak day demand beyond year 2020. However, average day demand is projected to exceed the average annual water rights of 0.71 mgd, beginning in year 2008. Sallal has been identified as a potential future wholesale customer of Seattle. Initial discussions have already begun regarding the possibility of Seattle providing Sallal with supplemental supply to meet Sallal's additional needs .

5.3.10 Sammamish Plateau Water and Sewer District

Sammamish Plateau Water and Sewer District (District) has its own ground water source, and serves a population of approximately 38,000. It is projected to grow by 56 percent from year 2000 to 2020. The District has two hydraulically separate service areas, the Plateau Zone and the Cascade View Zone. Each zone has its own wells, water rights, and demands.

The Plateau Zone has an average day supply constraint of 6.15 mgd and a maximum day supply constraint of 14.18 mgd. Projected average and maximum day demands are expected to exceed the available supply in 2007 and 2002, respectively.

The Cascade View Zone has an available average day supply of 0.41 mgd, which is sufficient to meet projected demands beyond 2020. However, maximum day demands are expected to exceed the available peak day supply of 0.72 mgd around 2008.

The District has four potential future supply options to provide additional supply to meet expected shortfalls. They include:

(1) continuing to pursue additional ground water rights and ground water recharge;
(2) connecting to the regional surface water system south of the District (via the Issaquah pipeline), blending surface water and ground water;
(3) connecting to the regional surface water system south of the District, but keeping a portion of the service area isolated form the surface water; and,
(4) connecting to the regional surface water system north of the District (via Seattle's Tolt Pipeline 2). Seattle has identified the District as a potential future wholesale customer.